MONTHLY WEATHER REVIEW.

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INTRODUCTION.

The REVIEW for February, 1894, is based on reports from 3,139 stations occupied by regular and voluntary observers. These reports are classified as follows: 153 reports from Weather Bureau stations; 41 reports from U. S. Army post surgeons; 2,191 monthly reports from state weather service and voluntary observers; 30 reports from Canadian stations; 221 reports through the Southern Pacific Railway Company; 475 marine reports through the co-operation of the Hydrographic Office, Navy Department, and "New York Herald Weather Service;" 28 weekly reports from 10 U. S. Life-Saving stations; no reports from navigators on the Great Lakes; monthly reports from local services established in all States and Territories; and international simultaneous observations. Trustworthy newspaper extracts and special reports have also been used.

The WEATHER REVIEW for this month has been prepared under the general editorial supervision of Prof. Cleveland Abbe. The statistical data is furnished by the Records Division, in charge of Mr. A. J. Henry, acting chief of that division.

CHARACTERISTICS OF THE WEATHER FOR FEBRUARY, 1894.

HIGH AREAS.

The most important area of high pressure was No. VII, hich passed from Assiniboia and Alberta on the 19th to Wyoming on the 23d and prevailed over the central Rocky Mountain plateau until the 28th. Maximum pressures of 31.04 occurred at Calgary, Alberta, on the 19th, and 31.00 at Cheyenne, Wyo., on the 23d. The lowest temperatures recorded in this connection were, on the 19th, —38, and on the the 20th and 21st, —44, at White River, Ont; on the 23d, —20, at Williston, N. Dak., —16, at Moorhead, Minn., —12, at Huron, S. Dak., Bismarck, N. Dak., and Cheyenne, Wyo.

LOW AREAS.

The lowest pressure recorded during the month was 28.80 at the center of low area No. VII on the 15th at Eastport, Me., attending the severest storm of the month.

TEMPERATURE.

The temperature of the month was generally below the average, and especially so on the northern, middle, and southern Rocky Mountain slopes, the southern plateau, the west Gulf States, and the Pacific coast.

PRECIPITATION.

The total precipitation (rain and melted snow) was above the average in the east Gulf, south and middle Atlantic States, and on the north Pacific coast. The snowfall was far above the average for February in the Appalachian range, the Middle and Eastern States.

AURORAS.

A remarkably extensive and interesting aurora occurred on the 22d and 23d, and reports of its visibility have been received from every State, except Alabama, Arkansas, District of Columbia, Florida, Georgia, Indian Territory, Louisiana, Mississippi, South Carolina, and Texas.

ATMOSPHERIC PRESSURE.

[*In inches and hundredths.*]

The distribution of mean atmospheric pressure reduced to sea level for February, 1894, as determined from observations taken daily at 8 a. m. and 8 p. m. (seventy-fifth meridian time), is shown by isobars on Chart II, which also gives the so-called resultant wind direction for this month; these resultants are also given numerically in Tables VIII and IX of the present REVIEW. The pressures here charted are those shown by mercurial barometers uncorrected for the effect of the variation of gravity with latitude. This correction is shown by the numbers printed on the border of Chart II; it should be applied and new isobars drawn by those engaged in special researches.

The normal distribution of atmospheric pressure and normal resultant wind direction for the month of February were approximately shown on Chart VIII of the REVIEW for February, 1893, as computed by Prof. H. A. Hazen, and are not now reproduced. As compared with the normal for February, the mean pressure for the current month was deficient from Lake Superior north and west to British Columbia. The greatest deficiency in pressure at Weather Bureau stations was 0.04 at Williston, N. Dak.; pressure was 0.01 below the normal in North Carolina, central Mississippi, and Alabama, and above the normal in all other States. The maximum excesses were 0.11 at Eastport, Me.; 0.10 at Albany, N. Y.; 0.12 at Cheyenne, Wyo.; 0.11 at Salt Lake City, Utah; 0.10 at Eureka, Cal. This belt of average highest excess, therefore, stretches almost continuously from Maine westward to northern California. The principal region of small excess covers the south Atlantic and Gulf States.

As compared with the preceding month of January, 1894, the mean pressure for February fell 0.05 or less throughout the Atlantic and east Gulf States, California, Arizona, and New Mexico; also in Alberta, Saskatchewan, Assiniboia, and Manitoba. Pressure rose from 0.14 to 0.17 over a narrow

ridge extending from Idaho and Montana southeast over Wyoming and Colorado into northern Texas.

The periodic diurnal variations of pressure are shown by the hourly means given in Table VI.

PATHS OF HIGH AND LOW AREAS.

The paths pursued by centers of high and low pressure during February, 1894, are shown on Charts IV and I, respectively, and the duration and velocity of these movements are given in the table at the end of this chapter. The charts show by small circles the positions of the centers. Within the circles are given the pressures reported nearest the centers and the corresponding dates. If a decided trough of low pressure or ridge of high pressure exists at that time, its location is shown by a short wavy line through the center. Sometimes distant centers are connected by such ridges or troughs, but the middle portion of the wavy line is omitted in order to avoid confusing the map.

HIGH AREAS.

I, II, and III.—On the 1st, a. m., a ridge of high pressure extended from Washington to Missouri; this moved slowly eastward and on the 2d, a. m., the eastern extremity of the ridge was on the middle Atlantic coast as a detached area, No. II, while the western extremity continued in Washington and Oregon. The barometer continued high on the Pacific coast and Rocky Mountain plateau region until the 7th, a. m., and a detached area, No. III, of high pressure moved slowly southeastward over Utah into Texas and thence eastward to the south Atlantic coast. By the 8th, a. m., the principal region of high pressure had retreated westward over California, and the high barometer off the Pacific coast did not again advance eastward, so as to encroach upon the Rocky Mountain plateau region, until the end of the month.

In connection with this area cold-wave warnings were sent on the afternoon and night of the 3d to the Gulf States, from Texas eastward to Georgia, and also to northern New York and New England. On the 4th, a. m., warnings were sent to the middle and south Atlantic coast.

IV and V.—The map of the 7th, p. m., shows a pressure of about 30.2 off the south Atlantic and the south California coasts and a pressure of 29.7, or less, in Texas, the Lake region, Montana, and the intermediate region. This condition was followed by a general movement from the Canadian territory southward, and by the 8th, p. m., areas of high pressure had appeared moving southward in Alberta (IV) and Ontario (V). High area No. V moved eastward over Newfoundland and disappeared on the 9th. High area No. IV, whose central pressure was north of Alberta, moved slowly southward on the 9th, and apparently the pressure at its center must have risen while its temperature diminished. On the 10th, a. m., the highest isobar, 30.8, inclosed southern Alberta and western Assiniboia. The observations at hand do not suffice to decide whether we are to consider this central area as having moved southward into this position, or as having simply formed or developed in this location; probably the movement during the previous day had been slight and the phenomenon was mostly one of growth, depending upon the presence during the 9th of a region of low pressure advancing northeastward into British Columbia. From the 10th to the 14th, high area No. IV moved eastward at the northern limit of our stations, and finally disappeared over the Gulf of St. Lawrence.

In connection with these high areas cold-wave warnings were sent on the 8th to South Dakota, Minnesota, Nebraska, Kansas, Iowa, Wisconsin, and eastern Colorado. On the 9th warnings were sent to Oklahoma, Missouri, Arkansas, Illinois, Wisconsin, Michigan, Indiana, Ohio, Kentucky, Tennessee, western New York, Pennsylvania, and Virginia. On the 12th, in anticipation of the great cold wave that occurred, a special cold-wave dispatch was sent to the Weather Bureau observers throughout the region from Kansas and Wisconsin southward to the Gulf and eastward to Florida and the middle and south Atlantic States announcing the approach of a protracted and severe cold wave. A special bulletin announcing freezing temperature in the sugar regions of Louisiana was sent to New Orleans on the 12th and 14th.

VI.—On the 13th and 14th pressure was high from Manitoba southwestward to California, and a high area remained central in Utah. This was a portion of a ridge of high pressure extending from California to Manitoba and Labrador, while areas of low pressure developed on its southern side in the Gulf States and on its northwestern side in Washington and British Columbia. By the 15th this ridge was represented by rather high pressures in Manitoba, California, and Texas, the latter area representing the center that had previously existed over Utah. On the 16th this moved eastward to the south Atlantic coast and disappeared in the rear of the low area (VII) that was then passing northeast over Nova Scotia.

VII and VIII.—During the 16th to the 18th pressure was high over California and the south Atlantic States, but was generally low in the interior of the United States; by the 17th, a. m., two areas of low pressure had moved to British Columbia and Lake Superior, respectively, and an area of high pressure had begun to appear in Alberta; the barometer rose very rapidly in this region, attaining its maximum, 30.96, at Medicine Hat, Assiniboia, and 31.04, at Calgary, Alberta, on the 19th, a. m. Up to this time the low pressure had remained on the Pacific coast, and winds had been light in Alberta, with steadily falling temperatures; it seems probable that the area of high pressure thus developed on this portion of the northeast slope of the Rocky Mountains was due to the flow of an upper current from the north. By the 19th, p. m., a ridge of high pressure extended from Alberta to North Dakota; by the 20th, a. m., the area of rising pressure had extended far to the southeast and east; the pressure had fallen in Montana and Alberta, and was still apparently highest in the latter. During the 20th, 21st, and 22d a ridge of 30.7 to 30.9 extended from Oregon to Kansas, and by the 23d, a. m., the highest pressure, 31.0, was central at Cheyenne, Wyo., but on the 23d, p. m., three minor maxima prevailed in Idaho, Minnesota, and Ontario. Pressure continued high over the central Rocky Mountain plateau during the 23d to 28th, inclusive, but slowly diminished from 30.9 to 30.3. On the 23d the eastern portion of high area No. VII passed eastward near Lake Superior, and thence southeast over Lake Ontario, and disappeared on the 25th off the coast of New England.

In connection with these areas of high pressure, but especially when cloudy areas were cleared away by colder dry air, numerous warnings were issued for minor cold waves as follows: 16th, to South Dakota, Wyoming, Nebraska, Minnesota, and eastern Colorado. 17th, to Nebraska, Kansas, Oklahoma, Texas, Arkansas, Missouri, Iowa, Illinois, and portions of Louisiana and Tennessee. 18th, to Wyoming, Colorado, Nebraska, Wisconsin, Minnesota, Michigan, western New York, and southward to Tennessee, Arkansas, and Oklahoma. 19th, warnings were sent to the regions still further south, viz, Texas, Louisiana, Tennessee, Mississippi, Alabama, Georgia, South Carolina, North Carolina, Virginia, Maryland, and Pennsylvania. 20th, to New Jersey, New York, and New England. On the 20th, also, special warning of a norther on the coast was sent to observers and railroad officials on the coast of Texas, Louisiana, Alabama, and Florida, and on the 21st warnings of an approaching cold wave to the interior of those States and also to Georgia, North and South Carolina. On the 23d warnings were issued to New York and New England, in connection with the cold wave that attended the eastern portion of high area No. VII.

IX.—On the 25th, a. m., the southeastern portion of high area No. VII was central in Texas, whence it moved east and northeast, and on the 27th disappeared on the middle Atlantic coast.

LOW AREAS.

I.—This depression appeared in Alberta on the 31st of the preceding month; it had evidently come from the Pacific coast of southern Alaska; it moved eastward along the northern border of our stations and disappeared on the 3d in Labrador.

II.—A general depression extended northeastward on the 2d over Mexico into Texas, where the pressure was low on the 2d, 8 p. m., with cyclonic winds and light rain. Out of this condition a well-marked low area developed in that State, which, on the 3d, a. m., was central on its eastern border. This depression moved east and northeast, with an increasing area of rain and snow, and after passing near Cape Hatteras, N. C., apparently developed into a still more severe storm.

In connection with this depression, warnings of high winds were sent to south Atlantic coast stations on the 3d and middle Atlantic stations on the 4th. In the rear of this storm the northwest winds on the Gulf coast were also signaled on the 4th.

III, IV, and V.—On the 5th the pressure was low in Alberta, and an extensive depression prevailed thence eastward for several days; this also extended southward until, by the 7th, p. m., three centers of low pressure, with cyclonic whirls, had developed, viz, No. III in Assiniboia; No. IV on Lake Superior; and No. V in Texas. No. IV passed rapidly eastward and disappeared on the 8th over the Gulf of St. Lawrence. No. III moved slowly eastward and disappeared on the 8th in Manitoba, while the southernmost of the three centers, viz, No. V, moved northeastward and rapidly increased in intensity; it was central in southern Illinois on the 8th, p. m., where its path turned to the northwest, after which it resumed its northeastward movement, passing over Lake Michigan and Lake Huron. This turn toward the northwest was accompanied by an extensive snowfall on the north and northwest sides of the central depression, and illustrates the general principle that the amount and distribution of latent heat evolved during a rainfall, and still more so during a snowfall, has an appreciable influence in modifying the intensity and movement of the central barometric depression and the cyclonic whirl. On the 10th, p. m., the area of snow prevailed on the west, south, and east sides of this low pressure, which was then central north of the St. Lawrence, and a new depression, with a cyclonic whirl, had begun to form off the coast of New England; by the 11th, a. m., the former disappeared and the latter was central off Nova Scotia.

On the 7th, while low area No. V was developing in Texas, signals for southeast winds were displayed along the Gulf coast; on the 8th, as the center approached the Lake region, the signals for northeast winds were displayed on Lake Michigan; on the 9th wind signals were displayed on the middle and east Atlantic coasts for easterly winds and on the 10th for westerly winds.

Severe tornadoes occurred on the southeast side of this depression on the 8th and 9th; warnings of these were sent as follows. On the 8th, at 10 a. m.:

To the observers in Tennessee, southern Illinois, Arkansas, and Missouri. Conditions are favorable for severe local storms this afternoon or evening.

And again on the 9th, at 10 a. m., as follows:

To observers in central and eastern Iowa, Missouri, Illinois, Indiana, Milwaukee, Grand Haven, Kentucky, Ohio, West Virginia, and Detroit. Conditions are favorable for the occurrence of severe local storms this afternoon or this evening in the States of the Ohio and the upper Mississippi valleys.

VI.—During the 8th an area of low pressure approached Washington, and afterward stretched southeastward as the eastern end of a trough reaching from the Pacific Ocean to the Rocky Mountain plateau. In reference to this barometric depression and storm, Mr. B. S. Pague, Local Forecast Official at San Francisco, Cal., writes:

This storm moved as follows: February 8, 8 a. m., central over extreme northwestern Washington, with a slight secondary depression central at Keeler, Cal.; 8 p. m., both depressions increasing in energy and stationary. 9th, 8 a. m., the first moving southeastward, the secondary one nearly stationary; 8 p. m., the secondary low increased by the addition of the original low, extending over western and southern Nevada and eastern California. 10th, 8 a. m., the low central at Keeler, Cal., with an easterly extension over Arizona.

The fall in the barometer on the 8th, 9th, and 10th at Los Angeles and San Diego, Cal., was caused by the southerly movement of the low and not by any low moving in from the ocean on the west of Los Angeles, Cal. The forecasts made at this office were based on the movements of the low above, briefly outlined, and they were verified.

On the 10th, a. m., this area was central in southern Nevada; it then passed southeastward into Texas, where it was central on the 11th, a. m., after which it turned northeastward, passing over Arkansas on the 11th, p. m., Kentucky, 12th, a. m., and Ohio, 12th, p. m.; by this time the northeast wind on the Atlantic coast, pressing inland over the middle Atlantic States, had started a new cyclonic whirl in North and South Carolina, which was now apparently central over Chesapeake Bay; after this the former whirl died away while the latter apparently moved northeastward over the Atlantic. The storm of wind and rain or snow attending this depression was very severe in the Gulf States, on the Atlantic coast, and the Lake region.

On the 10th, p. m., while low area No. VI was in Texas, the approaching southeast winds were signaled on that coast and on the 11th, a. m., along the rest of the Gulf coast. During the 11th the ensuing northwest winds on the Gulf coast were signaled, and easterly winds were signaled on the Lake region, and the middle and south Atlantic coasts; on the 11th, p. m., the observer at Montgomery, Ala., was advised as follows:

Rain, probably changing to snow in northern portion; cold wave; conditions favorable for severe local storms.

On the 12th, a. m., northwest winds were signaled on Lake Michigan and northeast winds on the middle and east Atlantic coasts. At 3 p. m. the following was sent to the observer at Buffalo:

Reports received during the day show the storm to be very severe throughout Ohio, Pennsylvania, and western New York, with probabilities of heavy snow to-day and to-night, followed by a cold wave. Distribute information to railroads running out of Buffalo.

Special warnings were sent throughout the middle States and New England, as follows:

Notify press, shipping interests, and railroads that the storm of to-night and Tuesday will be unusually severe; heavy northeast gales and heavy snow.

And again:

Notify shipping of unusually severe storm, and advise vessels not to leave port.

The storm of Monday, February 12, was fully predicted and according to the report of Mr. E. B. Dunn, Local Forecast Official at New York, N. Y., 156 telegrams and at least 40 telephone messages were sent by him to various persons and places and to the local and general press associations. The newspapers gave the Weather Bureau the credit of probably saving much property and many lives and a great deal of the delay and inconvenience of traffic that usually occurs in such heavy storms. Mr. Dunn states that this is the first instance on record where the larger transatlantic steamers remained in port, and that not a vessel of any description left after the warning was given; many railroad and steamboat companies thanked the Weather Bureau for the warnings. No wrecks were reported. Fourteen inches of snow fell within ten hours, or 20 per cent more than fell within an equal time during the great blizzard of March, 1888.

Among other items in connection with this storm we note the following:

In the easterly gale of the 12th and 13th, at Cape Cod, Mass., the three-masted schooner *E. I. Morrison* was destroyed at Peaked Hill Bar. A terrible blizzard of north wind and snow followed the east gale at Cape Cod on the 15th.

The schooner *Minnie Rowan* was wrecked at Scituate, Mass., about 11 p. m., February 12, but the crew was rescued by 10 p. m. of the 13th.

The "Boston Globe" of February 14, says:

Capt. C. F. Williams, agent for the Portland Steam Packet Company, who has perfected a system which in itself is a weather bureau, was at the Boston office of that company on February 12 advising a number of captains of vessels who were anxious to sail, although a storm was impending. After reading a number of dispatches from New York, Eastport, and intermediate places, the captains all concluded to remain in port.

During this storm captains of vessels passing Minot's Ledge Lighthouse stated that the sea was making a clean breach over the tower, spraying high in the air above. The Cunard steamer *Catalonia* sailed at high water, notwithstanding the storm.

At Portland, Me., on February 13, a very heavy vapor hung over the water in the harbor this morning, with intense cold, more so than ever known before. Men exposed to its touch for a few minutes found they were freezing. This remarkably cold vapor or fog extended as far as Seguin, Me., and greatly troubled the crew of the schooner *Lucy J. Warren*, as well as the steamers along the coast.

VII.—On the 12th, a. m., an area of low pressure was central over the Gulf of California, having apparently moved eastward from the Pacific over a route a little south of that followed by low area No. VI. This depression extended over northern Mexico, while northerly winds prevailed in Texas during the 13th. By the 14th, a. m., a well-marked depression and cyclonic whirl was evidently present in the Gulf of Mexico, south of Louisiana; this depression may properly be considered as originating in the western portion of that Gulf on the 13th in consequence of the steady northerly winds induced by the presence of the general depression over Mexico. In the absence of definite information to the contrary, this must be accepted as another illustration of a whirl and storm formed by the flow of cold northerly air from the Rocky Mountain plateau and slope southward into the warm air over the Gulf of Mexico. By the 15th, a. m., the storm center had passed from the Gulf northeastward over the south Atlantic States, and was central on the coast of New Jersey. In the course of this progress there had been a decided tendency to the formation of two whirls, central on the 14th, p. m., near Knoxville, Tenn., and Savannah, Ga., respectively, but these had now again combined in one. During the 15th the cold northerly winds, with snow over the lower Lakes and New England, extended over the Atlantic to the south of the center of low pressure, while increasing easterly winds, with snow, prevailed over Nova Scotia and New Brunswick. The central barometric depression rapidly increased, and on the 15th, p. m., was near Yarmouth, N. S. On the 16th, a. m., the center had passed beyond Cape Breton, after which it disappeared from our maps.

Before low area No. VII had developed into a storm center information signals were displayed on the 13th at the Gulf stations; on the 14th on the south Atlantic coast, and subsequently on the middle and east Atlantic coasts. On the 15th signals were displayed for northwest to northeast winds at the latter stations.

VIII, IX, and XI.—The two preceding depressions, originating on the southwestern border of the United States, were followed by a depression that first appeared on the extreme northwestern corner. Pressure began falling in British Columbia on the 12th, p. m., and by the 13th, p. m., had recovered, but on the 14th again fell, while southerly winds continued to prevail from northern California to British Columbia, with frequent rain. By the 15th, a. m., the high pressure prevailing from the Mississippi Valley to the Pacific had retreated southward sufficiently to allow a trough of low pressure to penetrate eastward into Alberta; by the 15th, p. m., this trough had penetrated into Montana and Assiniboia, and by the 16th, a. m., into North Dakota. By the 17th, p. m., a depression was central on the northern shore of Lake Superior, while a trough containing several definite whirls and low centers Nos. IX and X extended thence westward through South Dakota to the coasts of Washington and Oregon. By the 18th, p. m., low area No. VIII was central in the Gulf of Saint Lawrence, and a series of troughs and centers of low pressure extended from Labrador southwest to Indian Territory and thence northwest to Washington and British Columbia. The area of highest pressure was north of this region and central in Alberta while larger areas of rather high pressure prevailed off the middle and south Atlantic and Gulf coasts and California. The general movement of this trough of low pressure was southward, and by the 19th, a. m., it had been divided by the penetration into Texas of northerly winds and high pressures, so that it was then represented by two low pressures, Nos. IX and XI, with a connecting trough from Arkansas to Labrador, and a separate low pressure, No. X, in California and Arizona. The depressions Nos. IX and XI filled up and disappeared on the 19th, but a third one, No. XII, also developed on that date at the mouth of the Saint Lawrence, and on the 20th disappeared in the Gulf of Saint Lawrence.

On the 16th, as low area No. VIII approached the upper Lake region, southeast winds were signaled on Lake Michigan; 17th, information signals were sent to the middle and east Atlantic coasts, where high southwest winds subsequently prevailed.

X.—The depression, which we have called No. X, extended on the 17th, p. m., as a trough from Washington southeastward into Idaho; it gradually moved southward, and on the 19th, a. m., extended over northern California and Nevada. By the 20th, a. m., a depression and cyclonic whirl had formed on the southeastern slope of the Rocky Mountains, central in the northwestern corner of Texas, where pressure had fallen very rapidly; this was evidently the ordinary case of the formation of a new whirl on the eastern side of the plateau and far to the southeast of the original whirl or trough on the western side of the plateau. The new center continued its rapid southeastern movement, and by the 20th, p. m., it was central in Louisiana, and the 21st, a. m., still farther south, on the coast of Louisiana, while northerly winds prevailed over the Texas coast and thence northeastward to New York. These winds represented the front of the advancing area of high pressure; rain or snow prevailed along the entire front, with indications of several regions of incipient cyclonic whirls. On the 21st, p. m., the area of lowest pressure was in North Carolina and the frontal region of northwest winds, with rain or snow, had now passed over the Apalachian range. The area of lowest pressure disappeared on the 22d, a. m., off the south Atlantic coast, but the cold northerly winds that followed it must have again developed into a storm region on the Atlantic Ocean.

In connection with low area No. X northwest winds were signaled on the Texas coast on the 20th.

XI and XII.—See No. IX.

XIII.—While the preceding area, No. X, was, on the 20th–21st, existing as a slight depression on the south and southeast sides of the high area that was moving southward over the Rocky Mountain region, a larger general depression prevailed over northern Mexico and the adjacent Pacific coast. No well-defined area of low pressure was evolved out of this

depression, but its presence undoubtedly had much to do with the existence and southward advance of the great area of high pressure that prevailed over the United States from the 20th to the end of the month. On the 28th, p. m., the low pressure of the northwestern coast of Mexico, which I have called No. XIII, had reappeared and the map had resumed an appearance very similar to that of February 21 and 22.

XIV.—On the 21st pressure fell in Saskatchewan, Manitoba, and Ontario, and an area of low pressure, No. XIV, was evidently passing southeastward at some distance to the north of our telegraphic reports. On the 23d, p. m., it was central in lower Canada, and 23d, a. m., near the mouth of the Saint Lawrence, after which it passed southeastward apparently over Newfoundland.

Cautionary storm signals for northwest winds on the New England coast were displayed on the 23d, a. m.

XV.—This storm center began on the 23d as a slight depression in the Gulf of Mexico, in the region between the cold northerly winds and rain of the Gulf States and the warm easterly winds and clear weather of the Florida Peninsula. In all this region the barometer was at this time still above the normal, but it fell during the 24th and 25th, while rain and snow were falling in the south Atlantic and Gulf States. On the 25th, a. m., the center of the cyclonic whirl was in northwestern Florida, but by the 25th, p. m., it was near Cape Hatteras, N. C.; after this the center of the whirl moved to the north-northwest, passing over Washington on the 26th, a. m., after which it turned more abruptly eastward, and at 8 p. m. was east of Nantucket, Mass.

Information signals were displayed on the 23d at all Gulf coast and south Atlantic stations; on the 24th northeast storm signals on the south Atlantic coast and information signals on the middle and east Atlantic; on the 25th, northeast storm signals on the middle and east Atlantic coasts. In connection with the development of this storm on the 25th and 26th, the following special dispatch was sent, on the 25th, 11 a. m., to stations in the middle Atlantic States:

Snow will extend over the middle Atlantic States and upper Ohio Valley by Monday morning, with indications that snowfall will be heavy and may interfere with railroad travel. Give this information to all railroad officials and report by letter the distribution made of this dispatch.

On the 25th, 10.30 p. m., the following dispatch was sent to Boston:

Notify railroads in southern New England that heavy snow Monday will probably interfere with travel.

XVI.—An area of relatively low pressure prevailed over Alberta and to the westward from the 23d to the 26th, during which period the barometer fell slowly over the Rocky Mountain plateau and northward. On the 26th pressure recovered in British Columbia and Alberta, and the lowest pressure passed southeastward into Manitoba, where it was central the 26th, p. m. On the 27th the center passed eastward over Lake Superior, and on the 28th apparently filled up and disappeared in Ontario and Quebec.

XVII.—On the 27th, a. m., an area of low pressure appeared moving southeastward into Alberta, and on the 28th, p. m., it was apparently central in Manitoba.

MOVEMENTS OF CENTERS OF AREAS OF HIGH AND LOW PRESSURE.

The following table shows the date and location of the beginning and ending of each center of high or low pressure that has appeared on the U. S. Weather Maps during the month, together with the average daily and hourly velocities for the month. These averages will differ accordingly as we consider each path as a distinct unit, or give equal weight to each hour of observation.

Movements of centers of areas of high and low pressure.

Number.	First observed.			Last observed.			Path.		Average velocities.	
	Date.	Lat. N.	Long. W.	Date.	Lat. N.	Long. W.	Length.	Duration.	Daily.	Hourly.
High areas.		°	°		°	°	*Miles.*	*Days.*	*Miles.*	*Miles.*
I	1, a. m.	46	118	7, p. m.	34	121	1,200	6.5	184	8
II	1, a. m.	39	98	2, a. m.	37	78	1,100	1.0	1,100	46
III	4, a. m.	33	101	7, a. m.	33	81	1,300	3.0	433	18
IV	8, p. m.	55	114	12, p. m.	50	65	2,400	4.0	600	25
V	8, p. m.	47	80	9, p. m.	48	65	800	1.0	800	33
VI	12, p. m.	41	113	17, a. m.	35	74	2,800	4.5	622	26
VII	17, a. m.	54	116	28, p. m.	40	110	1,300	11.5	113	5
VIII	23, a. m.	50	90	25, a. m.	41	73	1,200	2.0	600	25
IX	25, a. m.	31	99	27, p. m.	37	73	1,900	2.5	760	32
Sums							14,000	36.0	5,212	
Mean of 9 paths									579	25.2
Mean of 36.0 days									389	16.2
Low areas.										
I	1, a. m.	54	113	3, a. m.	50	70	2,000	2.0	1,000	42
II	3, a. m.	33	95	4, p. m.	39	70	1,700	1.5	1,130	48
III	7, p. m.	50	109	8, p. m.	52	98	500	1.0	500	21
IV	7, p. m.	47	86	8, p. m.	47	64	1,100	1.0	1,100	46
V	7, p. m.	30	99	11, a. m.	45	59	3,000	3.5	857	36
VI	8, a. m.	48	124	13, a. m.	41	70	3,900	5.0	780	32
VII	12, a. m.	31	114	16, a. m.	47	59	3,800	4.0	950	40
VIII	13, a. m.	49	127	18, p. m.	48	64	3,000	5.5	546	23
IX	17, p. m.	45	104	19, p. m.	34	86	1,300	2.0	650	27
X	17, p. m.	44	125	22, a. m.	33	75	3,700	4.5	822	34
XI	18, p. m.	46	88	19, p. m.	39	70	800	1.0	800	33
XII	19, p. m.	50	66	20, a. m.	47	60				
XIII										
XIV	21, a. m.	49	101	23, a. m.	50	62	1,800	1.0	1,800	75
XV	23, p. m.	28	87	26, p. m.	42	68	1,800	3.0	600	25
XVI	25, p. m.	53	115	27, p. m.	48	83	1,500	2.0	750	31
XVII	27, a. m.	55	115	28, p. m.	53	99	600	1.5	400	17
Sums							30,500	38.5	12,685	
Mean of 15 paths									846	35.3
Mean of 40.5 days									792	31.4

NORTH ATLANTIC METEOROLOGY.

[*Pressure in inches and millimeters; wind-force by Beaufort scale.*]

The normal barometric pressure for February over the North Atlantic Ocean, as deduced from the international simultaneous observations, is highest, 30.20 (767), in a small region between N. 26°, N. 31°, W. 34°, and W. 40°, but pressure is very uniform from the northern coast of Africa westward to the Mississippi Valley. The region of lowest pressure, 29.50 (749), includes Iceland, the southeastern coast of Greenland, and the islands of Spitzbergen. The isotherm of 30° F. passes from New Jersey northeastward, south of Newfoundland and Iceland, to northern Norway and thence southward between Norway and Sweden. The tracks pursued by storm centers, the frequency and velocity of storms are very nearly the same as for January; the average speed is 37 miles per hour for the United States and 23 for the North Atlantic Ocean. The number of storm centers that have been traced entirely across this continent and the Atlantic Ocean averages scarcely *two* in February, but the number for the current month seems to be rather above the average.

As compared with January the normal pressure for February is about the same in the eastern portion of the Atlantic, but falls 0.05 over the United States and the western portion of the Atlantic and 0.10 in the region between N. 50°, N. 60°, W. 10°, and W. 35°. In general, all cyclonic whirls on the Atlantic during this month that develop into severe storms are formed at the southwestern end of large and shallow depressions where the colder and denser air driven southward by terrestrial gravitation and rotation combines with other